General

Guideline Title

ACR Appropriateness Criteria® tinnitus.

Bibliographic Source(s)

Kessler MM, Moussa M, Bykowski J, Kirsch CFE, Aulino JM, Berger KL, Choudhri AF, Fife TD, Germano IM, Kendi AT, Kim HJ, Luttrull MD, Nunez D Jr, Shah LM, Sharma A, Shetty VS, Symko SC, Cornelius RS, Expert Panel on Neurologic Imaging. ACR Appropriateness CriteriaÂ® tinnitus. Reston (VA): American College of Radiology (ACR); 2017. 11 p. [63 references]

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

NEATS Assessment

National Guideline Clearinghouse (NGC) has assessed this guideline's adherence to standards of trustworthiness, derived from the Institute of Medicine's report Clinical Practice Guidelines We Can Trust.

= Poor = Fair = Good = Very Good = Excellent

Assessment	Standard of Trustworthiness
YES	Disclosure of Guideline Funding Source
	Disclosure and Management of Financial Conflict of Interests
	Guideline Development Group Composition
YES	Multidisciplinary Group
YES	Methodologist Involvement

▮▯▯▯▯	Patient and Public Perspectives
	Use of a Systematic Review of Evidence
▮▮▮▮▮	Search Strategy
▮▮▮▯▯	Study Selection
▮▮▮▮▯	Synthesis of Evidence
	Evidence Foundations for and Rating Strength of Recommendations
▮▮▯▯▯	Grading the Quality or Strength of Evidence
▮▮▮▮▮	Benefits and Harms of Recommendations
▮▮▮▮▯	Evidence Summary Supporting Recommendations
▮▮▮▮▯	Rating the Strength of Recommendations
▮▮▮▮▮	**Specific and Unambiguous Articulation of Recommendations**
▮▯▯▯▯	**External Review**
▮▮▮▯▯	**Updating**

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Tinnitus

Variant 1: Subjective or objective pulsatile tinnitus (no myoclonus or Eustachian tube dysfunction).

Procedure	Appropriateness Category	Relative Radiation Level
CTA head with IV contrast	Usually Appropriate	☢☢☢
CTA head and neck with IV contrast	Usually Appropriate	☢☢☢
CT temporal bone without IV contrast	Usually Appropriate	☢☢☢
CT venography head with IV contrast	Usually Appropriate	☢☢☢
MRA head without and with IV contrast	Usually Appropriate	O
MRI head and internal auditory canal without and with IV contrast	Usually Appropriate	O
MRA head without IV contrast	May Be Appropriate	O
MR venography head without and with IV contrast	May Be Appropriate	O
Arteriography cervicocerebral	May Be Appropriate	☢☢☢
MR venography head without IV contrast	May Be Appropriate	O

Procedure	Appropriateness Category	Relative Radiation Level
MRI head and internal auditory canal without IV contrast	May Be Appropriate	O
US duplex Doppler carotid	May Be Appropriate	O
CT temporal bone with IV contrast	May Be Appropriate	☢☢☢
CT temporal bone without and with IV contrast	Usually Not Appropriate	☢☢☢

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Asymmetric or unilateral, subjective, nonpulsatile tinnitus (no otoscopic finding; no asymmetric hearing loss, neurologic deficit, or trauma).

Procedure	Appropriateness Category	Relative Radiation Level
MRI head and internal auditory canal without and with IV contrast	Usually Appropriate	O
MRI head and internal auditory canal without IV contrast	May Be Appropriate	O
CT temporal bone without IV contrast	May Be Appropriate	☢☢☢
CT temporal bone with IV contrast	May Be Appropriate	☢☢☢
CTA head with IV contrast	May Be Appropriate	☢☢☢
CTA head and neck with IV contrast	Usually Not Appropriate	☢☢☢
CT venography head with IV contrast	Usually Not Appropriate	☢☢☢
MRA head without IV contrast	Usually Not Appropriate	O
MRA head without and with IV contrast	Usually Not Appropriate	O
MR venography head without IV contrast	Usually Not Appropriate	O
MR venography head without and with IV contrast	Usually Not Appropriate	O
CT temporal bone without and with IV contrast	Usually Not Appropriate	☢☢☢
Arteriography cervicocerebral	Usually Not Appropriate	☢☢☢
US duplex Doppler carotid	Usually Not Appropriate	O
MRI functional (fMRI) head without IV contrast	Usually Not Appropriate	O
MEG	Usually Not Appropriate	O

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Symmetric or bilateral, subjective, nonpulsatile tinnitus (no hearing loss, neurologic deficit, or trauma).

Procedure	Appropriateness Category	Relative Radiation Level
CT venography head with IV contrast	Usually Not Appropriate	☢☢☢

Procedure	Appropriateness Category	Relative Radiation Level
CT temporal bone without IV contrast	Usually Not Appropriate	☢☢☢
MRI head and internal auditory canal without IV contrast	Usually Not Appropriate	O
MRI head and internal auditory canal without and with IV contrast	Usually Not Appropriate	O
CTA head with IV contrast	Usually Not Appropriate	☢☢☢
CTA head and neck with IV contrast	Usually Not Appropriate	☢☢☢
CT temporal bone with IV contrast	Usually Not Appropriate	☢☢☢
CT temporal bone without and with IV contrast	Usually Not Appropriate	☢☢☢
MRA head without IV contrast	Usually Not Appropriate	O
MRA head without and with IV contrast	Usually Not Appropriate	O
MR venography head without IV contrast	Usually Not Appropriate	O
MR venography head without and with IV contrast	Usually Not Appropriate	O
US duplex Doppler carotid	Usually Not Appropriate	O
Arteriography cervicocerebral	Usually Not Appropriate	☢☢☢
MRI functional (fMRI) head without IV contrast	Usually Not Appropriate	O
MEG	Usually Not Appropriate	O

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

Tinnitus is the perception of sound when no external sound is present. It is common, occurring in approximately 10% of the U.S. adult population. Tinnitus is not a disease; rather, it is a symptom that can result from a number of underlying causes. Tinnitus may be categorized as pulsatile or nonpulsatile, primary (idiopathic) or secondary to another condition, and subjective or objective.

"Pulsatile" tinnitus is a repetitive sound coinciding with the patient's heartbeat, whereas "nonpulsatile" tinnitus is a continuous or constant nonsynchronous sound. Nonpulsatile tinnitus is almost always "subjective" (heard only by the patient), and is the most common variant, often associated with presbycusis, medication toxicities, exposures to environmental noises, or additional etiologies. Subjective tinnitus is perceived only by the patient, and may be caused by a variety of otologic, neurologic, and metabolic disorders, most often in the setting of sensorineural hearing loss. "Objective" tinnitus is audible to the examining health care provider and should prompt evaluation for an underlying vascular abnormality.

Primary tinnitus is idiopathic, and may or may not have concomitant sensorineural hearing loss, and there is typically no cure. It may resolve spontaneously or symptoms can be mitigated with auditory, behavioral, or cognitive therapies. Secondary tinnitus is associated with an underlying source that may or may not require imaging to define. Etiologies range from cerumen impaction to middle ear or labyrinthine disorders, vascular abnormalities, vestibular schwannoma or intracranial hypertension.

The primary evaluation of tinnitus begins with a comprehensive otologic examination to determine if a vascular retrotympanic mass is present, audiometric examination, and review of medical history and medications (including over the counter), prior to imaging. The appropriateness of imaging examinations or modalities depends both upon the characterization of tinnitus and any related symptoms. It is common that tinnitus co-exists with other symptoms, therefore this document includes references to the ACR Appropriateness Criteria® Hearing Loss and/or Vertigo (see the National Guideline Clearinghouse [NGC] summary), Head Trauma (see the NGC summary), and Cerebrovascular Disease (see the NGC summary) guidelines to guide imaging in these settings. This is in accordance with the NGC summary of the American Academy of Otolaryngology - Head and Neck Surgery Foundation (AAO-HNSF) Clinical practice guideline: tinnitus, which also makes strong recommendations against imaging in patients with subjective, nonpulsatile tinnitus that does not localize to one ear and is not associated with a focal neurologic abnormality or asymmetric hearing loss. Those guidelines also focused on the impact of quality of life, noting that patients with tinnitus and severe anxiety or depression require prompt identification and intervention because suicide is reported in tinnitus patients with coexisting psychiatric illness.

Discussion of Procedures by Variant

Variant 1: Subjective or Objective Pulsatile Tinnitus (No Myoclonus or Eustachian Tube Dysfunction)

The main purpose for the imaging of patients with pulsatile tinnitus is to determine if an underlying anomaly or abnormality may be addressed with medical, endovascular, surgical, or radiation therapy. Primary considerations include vascular masses, aberrant arterial or venous anatomy, vascular malformations, and intracranial hypertension. Objective tinnitus is rare and has been attributed to turbulent flow in the setting of atherosclerotic carotid artery disease, jugular bulb abnormalities, abnormal condylar, and mastoid emissary veins, which may not be recognized as having a pulsatile component. Correlation with the physical examination prior to imaging is recommended, to appropriately distinguish patients with objective tinnitus related to muscle spasm/myoclonus or Eustachian tube dysfunction from those where a vascular cause is suspected.

CT and CTA

Dedicated temporal bone computed tomography (CT) is recommended as a first-line study in the setting of a vascular retrotympanic mass or subjective pulsatile tinnitus to determine if a paraganglioma or adenomatous middle ear tumor is the source of pulsatile tinnitus, or if there is variant vascular anatomy. Temporal bone CT is also sensitive for semicircular canal dehiscence; however, a risk of overestimation of superior semicircular dehiscence may occur in the absence of oblique reformats (in the planes Stenver and Poschl) given the intrinsic sloping of the petrous temporal bone.

Given concerns for a possible underlying vascular process, contrast-enhanced CT angiography (CTA) of the head and neck is also supported as a first-line imaging modality. Dedicated temporal bone CT reconstructions can be created from the high resolution source CTA images without additional radiation exposure to the patient, however, there is no evidence to support the practice of a combined CTA/CT temporal bone examination rather than one or the other alone or sequentially. Contrast bolus timing can be adapted to define arterial and venous anatomy, to identify vascular variants of the arteries, or persistent petro-squamosal sinus, and pathology such as dural arteriovenous fistula (AVF), arterial dissection, or sigmoid sinus wall diverticulum or anomalies (commonly associated with intracranial hypertension/pseudotumor cerebri syndrome). An advantage of CTA is bone algorithms that enable assessment of osseous channels in the bone in dural AVF, or dehiscence of the sigmoid plate or jugular bulb.

MRI and MRA

Magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA) have been shown to be of comparable accuracy to catheter angiography in small series and may be considered as a noninvasive alternative to screen for a suspected intracranial vascular malformation. Noncontrast MRI and MRA techniques are available for evaluating for vascular anomalies, malformations or dissection in patients with allergies or contraindications to iodinated contrast or gadolinium contrast. MRI of the internal

auditory canals and MRA techniques can characterize the relationship between nerves and blood vessels. There remains ongoing debate regarding the significance of vascular contact/impingement of the cisternal eighth cranial nerve and given the prevalence of normal, asymptomatic vascular loops, this finding should not obviate a search for another explanation for tinnitus.

Angiography

Craniocervical angiography is typically reserved for patients with objective pulsatile tinnitus, subjective pulsatile tinnitus with inconclusive noninvasive imaging findings, or for further characterization of an intracranial dural AVF identified on noninvasive imaging; it can also be used to better differentiate between a paraganglioma or lesion that may mimic a paraganglioma such as middle ear adenomatous tumors.

US

Carotid duplex or Doppler ultrasound (US) is helpful to delineate extracranial carotid stenosis when suspected as the prime cause of pulsatile tinnitus. Elevated extracranial carotid resistive indices and end diastolic velocity may be seen in the setting of intracranial vascular abnormalities, and should be addressed with intracranial modalities discussed above.

Variant 2: Asymmetric or Unilateral, Subjective, Nonpulsatile Tinnitus (No Otoscopic Finding; No Asymmetric Hearing Loss, Neurologic Deficit, or Trauma)

Nonpulsatile tinnitus may be described as ringing, buzzing, or clicking sensations. In this variant, a preceding clinical exam is important because otoscopy may identify a cause such as cerumen impaction, a middle ear infection, or mass. Any imaging decisions should be guided on those examination findings, rather than the symptom of tinnitus. If there is concomitant asymmetric hearing loss, neurologic deficit, or head trauma, imaging should be guided by the NGC summaries of the ACR Appropriateness Criteria® guidelines Hearing loss and/or vertigo, Cerebrovascular disease, or Head trauma, respectively.

MRI and MRA

In the setting of subjective nonpulsatile unilateral tinnitus without clinically evident cause or other associated symptoms, retrocochlear lesions, such as a vestibular schwannoma or other cerebellopontine angle cistern lesion, or auditory pathway masses are of concern. These are best evaluated with MRI of the internal auditory canals without and with contrast.

Unilateral tinnitus has also been associated with temporomandibular joint disorders, which may be evaluated with dedicated temporomandibular joint MRI protocols, although the mechanism is not clear.

Delayed MRI after intravenous or intratympanic contrast has been proposed for the detection of endolymphatic hydrops in the setting of Meniere disease, however this has not been validated or shown to be correlative with tinnitus symptoms.

CT and CTA

If the patient is unable to undergo MR imaging, CT may be helpful to evaluate for underlying vascular or osseous processes; however, CT has limited sensitivity in detecting small masses along the cranial nerves, cisterns, brain or brainstem. Dedicated temporal bone CT reconstructions can be created from high resolution source CTA images without additional radiation exposure to the patient, but there is no evidence to support the practice of a combined CTA/CT temporal bone examination rather than one or the other alone or sequentially.

Angiography

Arteriography is not routinely used in the evaluation of patients with nonpulsatile tinnitus.

US

US is not routinely used in the evaluation of patients with nonpulsatile tinnitus.

MEG and fMRI

Magnetoencephalography (MEG) and functional MRI (fMRI) have been used to better define brain activity and neural connections in patients with tinnitus, however these techniques remain in the research realm.

Variant 3: Symmetric or Bilateral, Subjective, Nonpulsatile Tinnitus (No Hearing Loss, Neurologic Deficit, or Trauma)

Imaging is not indicated in all cases of tinnitus symptoms, and is unrevealing in the setting of tinnitus related to medications, noise-induced hearing loss, presbycusis or chronic bilateral hearing loss. Whether CT or MRI is needed for evaluation of nonpulsatile tinnitus often depends on concomitant symptoms or examination findings such as hearing loss, neurologic deficit or head trauma, as tinnitus has been reported in the setting of hemorrhage, neurodegeneration, and spontaneous intracranial hypotension, among others.

Tinnitus in the setting of a nontraumatic neurologic deficit should be primarily guided by the onset of symptoms, with reference to the NGC summary of the ACR Appropriateness Criteria® Cerebrovascular disease guideline.

Please see the NGC summary of the ACR Appropriateness Criteria® Hearing loss and/or vertigo guideline to guide imaging of tinnitus in the setting of asymmetric hearing loss or vertigo, which may be associated with disorders of the middle ear (otitis or cholesteatoma), cochlea (labyrinthitis, otosclerosis, or intralabyrinthine hemorrhage), or central/neural structures (vestibular schwannoma and cerebellopontine angle masses, brainstem or auditory pathway lesions).

Tinnitus may also be a presenting or delayed symptom in the setting of a temporal bone fracture or vascular injury. See the NGC summary of the ACR Appropriateness Criteria® Head trauma guideline for additional detail.

CTA and CTV

CTA/CT venography (CTV) is not routinely used in the evaluation of patients with symmetric or bilateral nonpulsatile tinnitus.

MRI

MRI is not routinely used in the evaluation of patients with symmetric or bilateral nonpulsatile tinnitus.

MRA and MRV

MRA/MR venography (MRV) is not routinely used in the evaluation of patients with symmetric or bilateral nonpulsatile tinnitus.

US

US is not routinely used in the evaluation of patients with symmetric or bilateral nonpulsatile tinnitus.

Arteriography

Arteriography is not routinely used in the evaluation of patients with symmetric or bilateral nonpulsatile tinnitus.

MEG and fMRI

MEG and fMRI have been used to better define brain activity and neural connections in patients with tinnitus; however, these techniques remain in the research realm.

Summary of Recommendations

> In patients with pulsatile tinnitus, temporal bone CT and CTA are appropriate to evaluate for a middle ear mass or vascular etiology. MRI may be considered as a noninvasive alternative to screen for a suspected intracranial vascular malformation.

Given concern for retrocochlear process, MRI of the internal auditory canals is the most appropriate imaging test for subjective nonpulsatile unilateral tinnitus without a clinically evident cause or other associated symptoms.
If there is concomitant asymmetric hearing loss, neurologic deficit, or head trauma, imaging should be guided by those respective ACR Appropriateness Criteria documents, rather than the presence of tinnitus.
Imaging is not indicated in all cases of tinnitus symptoms, and is usually not appropriate for symmetric or bilateral, subjective, nonpulsatile tinnitus in the absence of other symptoms.

Abbreviations

CT, computed tomography
CTA, computed tomographic angiography
IV, intravenous
MEG, magnetoencephalography
MRA, magnetic resonance angiography
MRI, magnetic resonance imaging
US, ultrasound

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Tinnitus

Guideline Category

Evaluation

Management

Treatment

Clinical Specialty

Family Practice

Internal Medicine

Otolaryngology

Radiology

Intended Users

Advanced Practice Nurses

Health Care Providers

Hospitals

Managed Care Organizations

Physician Assistants

Physicians

Students

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of imaging procedures in the evaluation of patients with tinnitus

Target Population

Patients with tinnitus

Interventions and Practices Considered

1. Computed tomography angiography (CTA)
    - Head with intravenous (IV) contrast
    - Head and neck with IV contrast
2. Computed tomography (CT)
    - Temporal bone without IV contrast
    - Temporal bone with IV contrast
    - Temporal bone without and with IV contrast
    - Venography, head with IV contrast
3. Magnetic resonance angiography (MRA), head
    - Without and with IV contrast
    - Without IV contrast
4. Magnetic resonance imaging (MRI), head and internal auditory canal
    - Without and with IV contrast
    - Without IV contrast
5. Magnetic resonance (MR) venography, head and internal auditory canal
    - Without and with IV contrast
    - Without IV contrast
6. Arteriography, cervicocerebral

7. Ultrasound, duplex Doppler, carotid
8. Functional MRI (fMRI), head without IV contrast
9. Magnetoencephalography (MEG)

Major Outcomes Considered

- Utility of imaging procedures in evaluation of tinnitus
- Sensitivity, specificity, and accuracy of imaging procedures in evaluation of tinnitus

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Summary

A literature search was conducted in January 2014, September 2014, and March 2016 to identify evidence for the *ACR Appropriateness Criteria® Tinnitus* topic. Using the search strategies described in the literature search companion (see the "Availability of Companion Documents" field), 515 articles were found. Fifty-five articles were used in the topic. The remaining articles were not used due to either poor study design, the articles were not relevant or generalizable to the topic, or the results were unclear or biased.

The author added four citations from bibliographies, Web sites, or books that were not found in the literature searches because they were published outside of the search date ranges.

Four citations are supporting documents that were added by staff.

See also the American College of Radiology (ACR) Appropriateness Criteria® literature search process document (see the "Availability of Companion Documents" field) for further information.

Number of Source Documents

The literature search conducted in January 2014, September 2014, and March 2016 found 55 articles that were used in the topic. The author added four citations from bibliographies, Web sites, or books that were not found in the literature searches because they were published outside of the search date ranges. Four citations are supporting documents that were added by staff.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Definitions of Study Quality Categories

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - The study has important study design limitations.

Category 4 - The study or source is not useful as primary evidence. The article may not be a clinical study, the study design is invalid, or conclusions are based on expert consensus.

> The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
>
> *Or*
>
> The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
>
> *Or*
>
> The study is an expert opinion or consensus document.

Category M - Meta-analysis studies are not rated for study quality using the study element method because the method is designed to evaluate individual studies only. An "M" for the study quality will indicate that the study quality has not been evaluated for the meta-analysis study.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author assesses the literature then drafts or revises the narrative summarizing the evidence found in the literature. American College of Radiology (ACR) staff drafts an evidence table based on the analysis of the selected literature. These tables rate the study quality for each article included in the narrative.

The expert panel reviews the narrative, evidence table and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the variant table(s). Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Overview

The purpose of the rating rounds is to systematically and transparently determine the panels' recommendations while mitigating any undue influence of one or more panel members on another individual panel members' interpretation of the evidence. The panel member's rating is determined by reviewing the evidence presented in the Summary of Literature Review and assessing the risks or harms

of performing the procedure or treatment balanced with the benefits of performing the procedure or treatment. The individual panel member ratings are used to calculate the median rating, which determines the panel's rating. The assessment of the amount of deviation of individual ratings from the panel rating determines whether there is disagreement among the panel about the rating.

The process used in the rating rounds is a modified Delphi method based on the methodology described in the RAND/UCLA Appropriateness Method User Manual.

The appropriateness is rated on an ordinal scale that uses integers from 1 to 9 grouped into three categories (see the "Rating Scheme for the Strength of the Recommendations" field).

Determining the Panel's Recommendation

Ratings represent an individual's assessment of the risks and benefits of performing a specific procedure for a specific clinical scenario on an ordinal scale. The recommendation is the appropriateness category (i.e., "Usually appropriate", "May be appropriate", or "Usually not appropriate").

The appropriateness category for a procedure and clinical scenario is determined by the panel's median rating without disagreement (see below for definition of disagreement). The panel's median rating is calculated after each rating round. If there is disagreement after the second rating round, the rating category is "May be appropriate (Disagreement)" with a rating of "5" so users understand the group disagreed on the final recommendation. The actual panel median rating is documented to provide additional context.

Disagreement is defined as excessive dispersion of the individual ratings from the group (in this case, an Appropriateness Criteria [AC] panel) median as determined by comparison of the interpercentile range (IPR) and the interpercentile range adjusted for symmetry (IPRAS). In those instances when the IPR is greater than the IPRAS, there is disagreement. For a complete discussion, please refer to chapter 8 of the RAND/UCLA Appropriateness Method User Manual.

Once the final recommendations have been determined, the panel reviews the document. If two thirds of the panel feel a final recommendation is wrong (e.g., does not accurately reflect the evidence, may negatively impact patient health, has unintended consequences that may harm health care, etc.) and the process must be started again from the beginning.

For additional information on the ratings process see the Rating Round Information document (see the "Availability of Companion Documents" field).

Additional methodology documents, including a more detailed explanation of the complete topic development process and all ACR AC topics can be found on the ACR Web site (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current medical evidence literature and the application of the RAND/UCLA appropriateness method and expert panel consensus.

Summary of Evidence

Of the 63 references cited in the *ACR Appropriateness Criteria® Tinnitus* document, 5 are categorized as therapeutic references including 1 good-quality study, and 1 quality study that may have design limitations. Additionally, 57 references are categorized as diagnostic references including 2 good-quality studies, and 11 quality studies that may have design limitations. There are 40 references that may not be useful as primary evidence. There is 1 reference that is a meta-analysis study.

Although there are references that report on studies with design limitations, 3 good-quality studies provide good evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

- Determination of whether an underlying anomaly or abnormality may be addressed with medical, endovascular, surgical, or radiation therapy
- Improved quality of life

Potential Harms

- Computed tomography (CT) has limited sensitivity in detecting small masses along the cranial nerves, cisterns, brain or brainstem.
- Temporal bone CT has a risk of overestimation of superior semicircular dehiscence occurring in the

absence of oblique reformats (in the planes Stenver and Poschl) given the intrinsic sloping of the petrous temporal bone.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

- The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.
- ACR seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply society endorsement of the final document.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Kessler MM, Moussa M, Bykowski J, Kirsch CFE, Aulino JM, Berger KL, Choudhri AF, Fife TD, Germano IM, Kendi AT, Kim HJ, Luttrull MD, Nunez D Jr, Shah LM, Sharma A, Shetty VS, Symko SC, Cornelius RS, Expert Panel on Neurologic Imaging. ACR Appropriateness CriteriaÂ® tinnitus. Reston (VA): American College of Radiology (ACR); 2017. 11 p. [63 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2017

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The funding for the process is assumed entirely by the American College of Radiology (ACR). ACR staff support the expert panels through the conduct of literature searches, acquisition of scientific articles, drafting of evidence tables, dissemination of materials for the Delphi process, collation of results, conference calls, document processing, and general assistance to the panelists.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Neurologic Imaging

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

Disclosing Potential Conflicts of Interest and Management of Conflicts of Interest

An important aspect of committee operations is the disclosure and management of potential conflicts of interest. In 2016, the American College of Radiology (ACR) began an organization-wide review of its conflict of interest (COI) policies. The current ACR COI policy is available on its Web site. The Appropriateness Criteria (AC) program's COI process varies from the organization's current policy to accommodate the requirements for qualified provider-led entities as designated by the Centers for Medicare and Medicaid Services' Appropriate Use Criteria (AUC) program.

When physicians become participants in the AC program, welcome letters are sent to inform them of their panel roles and responsibilities, including a link to complete the COI form. The COI form requires disclosure of all potential conflicts of interest. ACR staff oversees the COI evaluation process, coordinating with review panels consisting of ACR staff and members, who determine when there is a conflict of interest and what action, if any, is appropriate. In addition to making the information publicly available, management may include exclusion from some topic processes, exclusion from a topic, or exclusion from the panel.

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Dr. Marek Bykowski reports personal fees from Impact Biomedicines, outside the submitted work. The other authors have no conflicts of interest related to the material discussed in this article.

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the American College of Radiology (ACR) Web site.

Availability of Companion Documents

The following are available:

ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2017. Available from the American College of Radiology (ACR) Web site.
ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2015 Feb. 1 p. Available from the ACR Web site.
ACR Appropriateness Criteria®. Evidence table development. Reston (VA): American College of Radiology; 2015 Nov. 5 p. Available from the ACR Web site.
ACR Appropriateness Criteria®. Topic development process. Reston (VA): American College of Radiology; 2015 Nov. 2 p. Available from the ACR Web site.
ACR Appropriateness Criteria®. Rating round information. Reston (VA): American College of

Radiology; 2017 Sep. 5 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2017. 4 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 2017. 125 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 2017 Mar. 4 p. Available from the ACR Web site .
ACR Appropriateness Criteria® tinnitus. Evidence table. Reston (VA): American College of Radiology; 2017. 26 p. Available from the ACR Web site .
ACR Appropriateness Criteria® tinnitus. Literature search. Reston (VA): American College of Radiology; 2017. 2 p. Available from the ACR Web site .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on March 15, 2018. The guideline developer agreed to not review the content.

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